"Me & My Brain": Exposing Neuroscience's Closet Dualism

Liad Mudrik[1,2] and Uri Maoz[1]

Abstract

■ Our intuitive concept of the relations between brain and mind is increasingly challenged by the scientific world view. Yet, although few neuroscientists openly endorse Cartesian dualism, careful reading reveals dualistic intuitions in prominent neuroscientific texts. Here, we present the "double-subject fallacy": treating the brain and the entire person as two independent subjects who can simultaneously occupy divergent psychological states and even have complex interactions with each other—as in "my brain knew before I did." Although at first, such writing may appear like harmless, or even cute, shorthand, a closer look suggests that it can be seriously misleading. Surprisingly, this confused writing appears in various cognitive-neuroscience texts, from prominent peer-reviewed articles to books intended for lay audience. Far from being merely metaphorical or figurative, this type of writing demonstrates that dualistic intuitions are still deeply rooted in contemporary thought, affecting even the most rigorous practitioners of the neuroscientific method. We discuss the origins of such writing and its effects on the scientific arena as well as demonstrate its relevance to the debate on legal and moral responsibility. ■

CLOSET DUALISM AND THE DOUBLE-SUBJECT FALLACY IN NEUROSCIENTIFIC WRITING

When the term "neuroscience" was coined about 60 years ago (Bechtel, 2009), few understood the revolution this discipline would bring about. With our expanding understanding of the brain, cognitive neuroscience has become a tool for better theorization of the mind. As part of that process, issues formerly considered "unscientific," such as the nature of consciousness or the existence of free will, have become legitimate foci of cutting-edge neuroscientific research (e.g., Poldrack, 2011; Cerf et al., 2010; Soon, Brass, Heinze, & Haynes, 2008). This "neuralization of the mind" (for a discussion, see Gold & Stoljar, 1999) may transform the way we think about mind–brain relations. If successful, it could yield cognitive-neuroscientific theories that will eventually replace the traditional, everyday intuitions that are typically rooted in more dualistic world views (Bloom, 2005; Damasio, 1994). Yet, surprisingly enough, careful reading of some prominent neuroscientific texts reveals that such a transformation has yet to be completed even within the brain sciences.

Although only few neuroscientists explicitly endorse Cartesian dualism (i.e., the idea that the mental and physical are two different substances, which can nevertheless interact), some prominent neuroscientific writing still expresses implicit dualistic intuitions. We exemplify this here with a key fallacy: ascribing divergent, even opposing, psychological states to the brain and to the person to whom the brain belongs. Hence, the brain is personified and, at the same time, it is differentiated from the "conscious self," so the brain and the self are described as two intentional subjects that may interact with one another and have different mental states.[1] Accordingly, we designate it the double-subject fallacy (DSF). For example: "the brain knows our decisions before we do" (Gazzaniga, 2000, p. 145) or "Our brain doesn't tell us everything it knows. And sometimes it goes further and actively misleads us" (Frith, 2007, p. 47). Table 1 lists more examples and suggests ways to rephrase DSF writing to eliminate the fallacy.

This type of writing might be claimed to be humorous or metaphorical shorthand that should be unpacked by the reader. We argue otherwise. First, DSF writing does not conform to any prominent theory of metaphors and their usage. Typically, metaphors, like "time is a river" or "conscience is a man's compass," are sentences in which a word or phrase that literally denotes one thing (a river or a compass, in the examples above) is used to denote another thing (time or conscience, respectively), thereby implicitly introducing a parallel between the two (Turner & Fauconnier, 2002; Lakoff & Johnson, 1980). However, in DSF writing, both the brain and the self (as well as the physical predicates assigned to them) are literally referenced: In sentences like "the brain decided before you did," for example, the brain is held to (literally) decide, and the person is held to (literally) decide later. There is no nonliteral meaning to any of the terms.

Second, beyond this more technical point, we claim that even if DSF writing was metaphorical, these metaphors would render neuroscientific texts less comprehensible rather than serve as helpful rhetorical tools. Undeniably, metaphors often aid scientific explanations and thought (Brown, 2003; Chew & Laubichler, 2003).

[1]California Institute of Technology, [2]Tel Aviv University

Journal of Cognitive Neuroscience 27:2, pp. 211–221
doi:10.1162/jocn_a_00723

However, metaphors can also confine science to a specific theory or mindset (Avise, 2001), evoke false conjunctions (LaBerge, 1995), or lead to inappropriate generalizations (Chew & Laubichler, 2003). Thus, metaphors can and sometimes do lead scientists astray, and DSF writing is a case in point. As we demonstrate below, the DSF adds nothing to the comprehensibility of neuroscientific theories. Instead, it purposelessly and potentially harmfully alludes to many readers' dualistic intuitions. In that, it unnecessarily complicates and derails the search for a comprehensive explanation of mind–brain relations by creating the false impression of explaining what has in fact remained obscure.

WHY DSF WRITING IS DUALISTIC

We argue that DSF writing reinforces what are already hard-to-shake dualistic intuitions, giving them superficially tempting although actually misleading neuroscientific legitimacy. The structure of Descartes' classical dichotomy between body and soul (Descartes, 1985) is remarkably preserved in some modern neuroscientific texts, yet now the dichotomy is portrayed as a dichotomy between the self and its brain. Compare the two following texts:

> …*our brains* can often decide well, in seconds, or minutes, depending on the time frame *we* set as appropriate for the goal *we* want to achieve, and if they can do so, they must do the marvelous job with more than just pure reason. (our emphases)

> …the activity of *the soul* consists entirely in the fact that simply by willing something it brings it about that *the little gland* to which it is closely joined moves in the manner required to produce the effect corresponding to this volition. (our emphases)

The texts are similarly dualistic. In both, the self/soul appears in charge of strategy, whereas the brain/gland translates it into tactics. Yet, whereas the second text is by the father of dualism, René Descartes (Descartes, 1985, CSM I:343), the first is from Antonio Damasio's well-known book *Descartes' error: emotion, reason, and the human brain* (Damasio, 1994, pp. 172–173).

Similarly, Chris Frith writes: "Your brain doesn't tell you when your body moved in a different way from what you intended" (Frith, 2007, p. 70), or suggests that "we" can outdo the tricks our brains play on us and trick them back by taking drugs, specifically LSD, so that we actively make our brains lie to us (i.e., change our perception; pp. 34–35). Such writing cannot be accommodated within a materialistic framework (as Frith acknowledges, p. 23). If "you" are divergent from "your brain," where do "you" reside in a materialistic model, and what differentiates "you" from "your brain" and allows an interaction between the two?

We claim that DSF writing is incompatible with a materialistic world view. In its most simplified form—that is, identity theory (Smart, 1959)—materialism holds that mental states are identical to brain states. Thus, if the brain and the person have two opposing mental states (e.g., in "the brain knows before you do," the brain's state is knowing and the self's not knowing), they also have two opposing brain states. This does not make much sense. The problem persists also in "lighter" versions of materialism, like supervenience (Kim, 1998), which postulates that there cannot be any mental change without an underlying neural change. Hence, if the brain and the person have different mental states, they should again have diverging brain states, reminiscent of the example above (a similar argument holds for emergence theories; see, e.g., Van Gulick, 2001).

Finally, this argument also applies to emergentist theories, which have gained traction in the neuroscientific community (or, as Michael Gazzaniga put is, "there seems to be a change in the air…. The leading neuroscientists are beginning to accept emergence"; Gazzaniga, 2010, p. 292). According to this approach, mental states emerge from and are reducible to neural states, but they are not identical with them and can also causally affect them (i.e., weak emergentism or emergent materialism; Stephan, 2006). DSF writing is incompatible with this world view too; the casual interaction the theory allows is between macro (mental states) and micro (neural states) properties of the brain, not between macro properties of the brain and those of the person to whom the brain belongs. Therefore, DSF writing cannot coexist with materialistic thought in its different versions (even for those who acknowledge that mental states are real and can have causal powers; see again the discussion of emergence above). Given the strong tie commonly suggested between neuroscience and materialism (Cacioppo & Decety, 2009; Haggard, 2005; Crick, 1994; Edelman, 1989), it is remarkable that such nonmaterialistic conceptions still find their way into neuroscientific writing.

The criticism we offer here does not reflect our own commitment to a specific ontological stand in the mind–body conundrum. Nor do we deny the reality of mental states (either in the emergentist sense above or in the functional one, according to which mental states are defined solely by their function and are accordingly different and separate from the neural states that realize them; Rey, 1997; Shoemaker, 1981; Putnam, 1967). Rather, we hold that mental states—irrespective of how these are defined—are states of the person and cannot be described as conflicting with another set of mental states, which are states of the person's brain.

WHY DSF WRITING SHOULD BE AVOIDED IN COGNITIVE NEUROSCIENCE

Apart from reflecting dualistic notions, we claim that DSF writing—even if regarded as metaphorical or figurative—is detrimental to cognitive neuroscience and should be avoided. First, it introduces unnecessary confusions into a discipline that often encounters conceptual, operational,

and analysis-related difficulties in its ongoing endeavor to discover the neural underpinnings of cognitive and mental processes (e.g., Maoz et al., 2015; Ioannidis, Munafò, Fusar-Poli, Nosek, & David, 2014; Simmons, Nelson, & Simonsohn, 2011; Vul, Harris, Winkielman, & Pashler, 2009; Mele, 2007; Bennett & Hacker, 2003; Block, 1995). Cognitive neuroscientists, conducting pioneering work, have a hard enough time steering clear of subtle confounds while often investigating ill-defined phenomena; there is no need to add conceptual confusions to this already-challenging work by describing the brain and the person to whom it belongs as two separate subjects, capable of interacting and having divergent mental states. Second, as such writing appeals to everyday intuitions about the existence of a conscious self that is divergent from its corporeal body (Bloom, 2005; Damasio, 1994), it obfuscates that which has yet to be explained—how the human mind works and how it is subserved by the brain.

Let us take Damasio's quote above as a case in point. The text is a part of his account of decision-making, in which emotion plays a crucial part (i.e., the somatic-marker theory; Damasio, Everitt, & Bishop, 1996). The somatic-marker hypothesis offers much explanatory power about emotional involvement in decision-making and makes testable predictions (e.g., that patients with impaired emotional functioning would demonstrate poorer decision-making). However, it is harder to decipher from Damasio's description what the neural underpinnings of this emotional contribution to deciding are.

Saying that the brain relies on "more than pure reason" to decide how to execute the actions required to achieve the goals "*we* want to achieve" (our emphasis) does not explain how "we" choose these goals. More importantly, the division between the processes of deciding which goals should be achieved (of which the person, or "we," are in charge) and those of deciding how to execute those goals (assigned here to the brain) is left unexplained. Is this a division between subjects' conscious experience of deciding and the underlying neural mechanisms? If so, this is a fascinating, widely discussed division that requires an explanation. Yet, we claim that Damasio's description above provides no such explanation; rather than explaining the brain's involvement in decision-making and in voluntary action and its enigmatic relations with our conscious experience of reaching these decisions, the description above relies on newer neural terms (e.g., the brain, the frontal lobes, the nervous system) to convey long-standing ideas (i.e., that the conscious self somehow controls the brain and the body). This leaves more unexplained than is initially apparent. Such usage of neural terms creates the false impression that a new, neuroscientific theory or explanation of the relations between mind and brain has been put forward.

Similarly, there is no explanatory gain in saying that the brain does not "tell you" about your bodily movements (Frith, 2007, p. 70). We suggest that a better phrasing is that you are unaware of these movements (for other examples of DSF-free formulations of DSF writing, see Table 1). Here, as in other neuroscientific texts (e.g., Aamodt & Wang, 2008; Fine, 2006; Baars, 1997), behavioral findings are described in a "neural language," making them appear to rely on neural data. However, these texts actually describe dissociation between two behaviors, two neural states, or two mental states—one driven by conscious processes and the other driven by unconscious processes. Importantly, both belong to the person and occur in or are substantiated by the person's brain. There is therefore no reason or gain in describing the conscious state as belonging to the person and the unconscious one as belonging to the brain. Such DSF descriptions reinforce dualistic intuitions, while masking the fact that no new explanation has been put forward for the difference between conscious and unconscious states and their underlying neural mechanisms.

This confusion about the appropriate description of conscious and unconscious processes revives the dualistic mind–body dichotomy, as exemplified in sentences like "there is a dissociation between what the brain knows and what the patient claims to experience" (Baars, 1997, p. 366). This sentence describes a blindsight patient (Weiskrantz, 1996; Farah, 1994) who denies seeing a pair of scissors yet is able to reach for them. This once again reflects dissociation between two cognitive or neural states: the patient's conscious experience and the patient's unconscious processing of the information of which she is unaware. Yet, it is described as dissociation between what the brain "knows" and what the patient does.

Note that, in this example and in others of its kind, what the brain "knows" is what the person does not: the unconsciously processed information. One does not write of the brain "knowing" when describing conscious experiences; it is only unconscious processes that are assigned to the brain. The conscious processes are assigned to the person. We claim that this reflects the hidden dualistic conception that conscious states are states of the person but not of the person's brain, whereas unconscious states belong to the person's brain rather than to the person as a whole. We deem this intuitive notion dualistic because it rejects the idea that both conscious and unconscious states are states of the person that are instantiated by her brain, as we explain above. People are able to consciously experience the world and unconsciously process many aspects of it, sometimes to a surprisingly high degree (e.g., Reber, Luechinger, Boesiger, & Henke, 2014; Sklar et al., 2012; Mudrik, Breska, Lamy, & Deouell, 2011; Lau & Passingham, 2007). Both the conscious experiences and the unconscious processes result from neural activity. The challenge of understanding the interplay of conscious and unconscious processes in shaping human experience is a key one that lies ahead for cognitive neuroscience (see Raffone, Srinivasan, & van Leeuwen, 2014, for a recent collection of articles). However, to meet this challenge, it would be wise to

overcome the old dualistic intuitions and to face the problem head on. We have only made baby steps in understanding the relations between mind and brain, and many fundamental problems are still unsolved. Until we stand on firmer empirical and theoretical grounds, we had better acknowledge these problems rather than obfuscate them by describing brains as intentional subjects that are able to interact with the persons to whom they belong. Such personification of the brain renders the discussion of mind–body relations too shallow and presents an incredibly complicated issue in an overly simplistic manner.

WHY DSF WRITING IS ALSO PROBLEMATIC OUTSIDE THE SCIENTIFIC ARENA

Thus far, we discussed the scientific and theoretical ramifications of committing the DSF. Yet, this way of thinking has further repercussions, for example, in the moral and legal domains: when "I" am separated from "my brain," which actually makes the decisions "for me," how can "I" be responsible for "my brain's" actions (or are they "my" actions)?

Philosophers and law scholars have been debating the scope and extent of moral responsibility for centuries, mostly in the context of free will and determinism (to name a few: Kane, 2002; Smilansky, 2000; Honderich, 1988; Zimmerman, 1988; Dennett, 1984; Fischer & Ravizza, 1984; Nagel, 1976; Frankfurt, 1969; Hart, 1968; Strawson, 1962; Schlick, 1939). However, this debate has now donned a new guise: the distinction between "me" and "my brain" that also permeates the daily praxis of the judicial realm. This is manifested in the "my brain made me do it" defense (Maoz & Yaffe, 2013; Sternberg, 2010), which is becoming increasingly popular (but see Gazzaniga, 2006; Morse, 2004; also relevant is the account of preconscious free will in Velmans, 2003).

For example, Jonathan Pincus, an expert on criminal behavior and the brain, writes: "When a composer conceives a symphony, the only way he or she can present it to the public is through an orchestra…. If the performance is poor, the fault could lie with the composer's conception, or the orchestra, or both…. Will is expressed by the brain. Violence can be the result of volition only, but if a brain is damaged, brain failure must be at least partly to blame" (Pincus, 2001, p. 128). The brain is here equated with the orchestra; the perpetrator's will, with the composer; and the violent act, with poor performance. If the musical performance is poor because of the orchestra, it is not the composer's fault. Thus, if the violent act is because of a damaged brain, the perpetrator's culpability should be mitigated. Therefore, in this analogy, the perpetrator's will is as divergent from her brain as the composer's symphony is from the orchestra (Greene & Cohen, 2004). The analogy relies on the intuition that a defendant's responsibility is mitigated if her actions can be attributed to some anomaly in her brain. This intuition is, at least to some extent, valid and reflected in the law. However, its description is problematic, differentiating between the self and the brain that "made" the self act illegally, as if the two can interact as two intentional subjects. This is another version of the DSF. This seepage into the judicial realm is more reason for neuroscientists to take care not to commit the DSF.

It should be noted that we do not claim that moral responsibility is impossible within a materialistic framework. Although moral responsibility is often described in relation to the notion of free will, which many consider to rely on dualistic ideas (Knobe, 2014; Montague, 2008; Bloom, 2007; Nichols, 2004), others suggest that folk conceptions of moral responsibility are not correlated with dualistic intuitions (Monroe, Dillon, & Malle, 2014; Nahmias & Thompson, 2014). Along the same lines, it has been claimed that neuroscience threatens neither the notion of free will nor that of moral responsibility and may, in contrast, lead to a better understanding of these concepts (Roskies, 2006). However, for this to happen, especially given the complexity of these issues and their important social implications, neuroscientists should avoid referring to "me" versus "my brain." When brain scientists make this false distinction—no matter how many times they deny any dualistic tendencies—those around them treat it as the word of the experts, thus strengthening the dualistic intuitions that drive DSF writing inside and outside neuroscience.

WHY DSF WRITING COMES ABOUT

Why are dualistic-oriented descriptions like the DSF found in the writing of professed materialists? Frith explains that he sometimes "sounds like a dualist," differentiating between "me" and "my brain," because "this is what experience is like" (Frith, 2007, p. 23). He seems to be suggesting that humans experience themselves in dualistic terms, which are reflected in DSF writing. This dualistic approach, cultivated and augmented for centuries by culture and religion (Boyer, 2001; Petrement, 1973), is indeed prevalent, appearing already at 4 or 5 years old (Bering & Bjorklund, 2004; Bloom, 2004).

However, dualism by itself does not bring about DSF writing; it is the intersection between the neuroscientific endeavor to explain mind–body relations in neural terms and the closet dualism of neuroscientists that gives rise to this confused way of writing. Scientifically and culturally, we seem to be in the midst of a transition period in our understanding of mind–brain relations, gradually moving away from long-held dualistic intuitions to more materialistic ones. Referring to the brain as the locus of thought and behavior is increasingly common. Much of this transition is driven by the cognitive-neuroscientific endeavor to piece together a neural account of the functions of the mind and to explain phenomena previously held nonphysical and unscientific, like rationality (Jastorff, Clavagnier, Gergely, & Orban, 2011; De Martino, Kumaran,

Table 1. Examples of the DSF

Publication	*Publication Type*	*Field*	*Interaction Type*	*Quote (Representative Example)*	*Rephrasing to Remove the DSF*
Aamodt & Wang, 2008	Popular science book	General neuroscience	Lying brain versus owner who should try to detect the brain's lies	"Your brain lies to you a lot…[it]has to take shortcuts and make lots of assumptions. Your brain's lies are in your best interest—most of the time—but they also lead to predicable mistakes. One of our goals is to help you understand the types of shortcuts and hidden assumptions your brain uses to get you through life. We hope this knowledge will make it easier for you to predict when your brain is a source of reliable information and when it's likely to mislead you." (p. 2)	"Your experience is often illusory…. It rests on shortcuts and lots of assumptions. These illusions are in your best interest—most of the time—but they also lead to predicable mistakes. One of our goals is to help you understand the types of shortcuts and hidden assumptions that get you through life. We hope this knowledge will make it easier for you to predict when your conscious experience is a source of reliable information and when it's likely to mislead you."
Baars, 1997	Theoretical article, consciousness and cognition	Consciousness and attention, blindsight	Knowing brain versus unknowing brain owner	"If we hold a pair of scissors before the eyes of blindsight patients, they would claim not to see anything, yet they might be able to reach for the scissors with thumb and forefinger extended to insert into the scissor loops. Thus, we can verify that some part of the visual brain knows about the scissors, though the patient disclaims any direct perceptual knowledge. There is a dissociation between what the brain knows and what the patient claims to experience." (p. 366)	"If we hold a pair of scissors before the eyes of blindsight patients, they would claim not to see anything, yet they might be able to reach for the scissors with thumb and forefinger extended to insert into the scissor loops. Thus, we can verify that some part of the visual brain processes information about the scissors, though the patient disclaims any direct perceptual knowledge. There is a dissociation between what is being unconsciously processed and what is being consciously experienced."
Cerf et al., 2010	Research article, *Nature*	Online control of neural activation (*authors' definition)	Controlled brain versus controlling brain owner	"…humans can regulate the activity of their neurons in the medial temporal lobe." (article abstract)	"Sensory feedback on successful attention allocation can modify the activity of neurons in the medial temporal lobe."
Damasio, 1994	Popular science book	Decision-making	Executing brain versus a willing and goal-setting brain owner	"…our brains can often decide well, in seconds, or minutes, depending on the time frame we set as appropriate for the goal we want to achieve, and if they can do so, they must do the marvelous job with more than just pure reason." (pp. 172–173)	"…decision processes in the brain are often successfully carried out, in seconds, or minutes, depending on the person's goal and time frame (possibly defined by higher level brain areas), and if this can occur, the brain must do the marvelous job with more than just pure reason." An alternative interpretation: "…we can often decide well, in seconds, or minutes, depending on the time frame we set as appropriate for the goal we want to achieve, and if we can do so, we must do the marvelous job with more than just pure reason."
Fine, 2006	Popular science book	Social neuroscience	Lying brain versus a naive brain owner	"Don't trust your brain…. [it] manipulates your perception of reality, thus tricking you into embracing vanities…don't feel too angry with your vain brain for shielding you from the truth." (p. 23)	"Don't trust your conscious experience…your perception of reality is inaccurate, which leads you to embrace vanities…don't feel too angry towards your illusory experience (or the unconscious mechanisms that underlie it) for shielding you from the truth."

Table 1. (*continued*)

Publication	*Publication Type*	*Field*	*Interaction Type*	*Quote (Representative Example)*	*Rephrasing to Remove the DSF*
Frith, 2007	Popular science book	Consciousness	Manipulative brain versus a brain owner who tries to overcome the brain's deceptions	"Our brain doesn't tell us everything it knows. And sometimes it goes further and actively misleads us." (p. 47)	"We don't have conscious access to all the information processed by our brains. And sometimes our conscious experience is misleading."
Gazzaniga, 2006	Popular science book	Neuroscience and understanding the mind	Knowing/deciding brain versus unknowing brain owner who is led by his or her brain	"Thus, it seems the brain knows our decisions before we do." (p. 145)	"Thus, is seems that decision processes are carried out unconsciously before we have conscious access to them."
Gazzaniga, 2000	Book chapter	Neuroscience and understanding the mind	Knowing/deciding brain versus unknowing brain owner who is led by his or her brain	"You know how active the automatic brain is, especially when you are awakened at 3 a.m. by a profusion of concerns swirling around in your mind. You can't get back to sleep because your brain is in charge." (p. 171)	"You know how active the automatic brain is, especially when you are awakened at 3 a.m. by a profusion of concerns swirling around in your mind. You can't get back to sleep because you can't control your thoughts."
Grinde, 1996	Theoretical article, *Journal of Social and Evolutionary Systems*	The neural basis of visual aesthetics	Rewarding and persuading brain versus an obedient brain owner	"…the brain is constructed to evoke these feelings as a means of helping you. Similarly, going to the toilet may not be conceived as a favorite source of joy, but your brain does reward you for emptying your bowels, because it is a natural and necessary action." (p. 33)	"…the brain is constructed to evoke these advantageous feelings. Similarly, going to the toilet may not be conceived of as a favorite source of joy, but the reward system in your brain is active after emptying your bowels, because it is a natural and necessary action."
Isnard, Magnim, Jung, Mauguière, Garcia-Larrea, 2011	Research article, pain	Pain	Executive brain notified about the sensation of its owner	"Does the insula tell our brain that we are in pain?" (article title)	"Does the insula decode/signal the sensation of pain?"
Keysers and Perrett, 2002	Theoretical article, *Trends in Cognitive Sciences*	Consciousness	Operating brain versus an operated brain owner	"Our brain makes 'us' aware of only one of these interpretations at a time by letting the alternatives compete neuronally." (p. 24)	"Our brain activity results in awareness of only one of these interpretations at a time via neuronal competition between the alternatives."
Koch, 2012	Popular science book	Consciousness, free will	Deciding brain versus inferring subject	"In terms of Libet's experiment, your brain decides that now is a good time to flex the wrist, and the readiness potential builds up. A bit later, the neural correlate of agency becomes active. It is to this percept that you incorrectly attribute causality. As these events take place in a flash, under a second, it's not easy to catch them." (p. 107)	"In terms of Libet's experiment, unconscious processes initiate the flexion of the wrist, and the readiness potential builds up. A bit later, the neural correlate of agency becomes active. It is to this conscious percept that you incorrectly attribute causality. As these events take place in a flash, under a second, it's not easy to catch them."
Koch, 2009	Book chapter	Free will	Deciding brain versus unknowing subject	"I discuss several cognitive neuroscience experiments suggesting that in many instances, our brain decides prior to our conscious mind, and that we are often ignorant of our brain's decisions." (chapter abstract)	"I discuss several cognitive neuroscience experiments suggesting that in many instances, unconscious decisions occur prior to our conscious experience of deciding, and that we are often ignorant of these unconscious processes."

Kornmeier & Bach, 2009	Research article, *Journal of Vision*	Consciousness	A brain that is impressed by external stimuli versus brain owner who does not notice them	"Object perception: When our brain is impressed but we do not notice it" (article title)	Object perception: When we are unconsciously impressed but do not consciously notice it"
LeDoux, 2002	Popular science book	The relations between synapses and the self	Dominating brain versus brain owner who tries to get free using downward causation	"This [the fact that unconscious emotional systems affect our behavior, L. M. & U. M.] doesn't mean that we're simply victims of our brains and should just give into our urges. It means that downward causation is sometimes hard work." (p. 323)	"This [the fact that unconscious emotional systems affect our behavior, L. M. & U. M.] doesn't mean that we're simply victims of these unconscious processes and should just give into our urges. It means that downward causation is sometimes hard work."
Leyden & Kleinig, 2008	Research article, *Medical Hypotheses*	BG's role in data processing	Executing brain versus a willing and goal-setting brain owner	"If a person wants to move a limb to a new position, the brain decides exactly what muscle fibers to use with what force."	"If a person wants to move a limb to a new position, neural processes in her brain excite the exact muscle fibers with the appropriate force."
Libet, 2003; Libet et al., 1983	Research articles; *Brain*, *Journal of Consciousness Studies*	Free will	Deciding brain versus a willing brain owner	1. "…conscious free will could not actually 'tell' the brain to begin its preparation to carry out a voluntary act." (Libet, 2003, p. 24) 2. "…the brain evidently 'decides' to initiate or, at the least, prepare to initiate the act at a time before there is any reportable subjective awareness that such a decision has taken place." (Libet et al., 1983, p. 640)	1. "…subjects' conscious experience of deciding could not actually initiate the neural preparation to carry out a voluntary act." 2. "…unconscious brain processes evidently initiate or, at the least, prepare to initiate the act at a time before there is any reportable subjective awareness that such a decision has taken place."
Moseley, 2003	Research article, *Journal of Pain*	Pain	Deciding brain versus an experiencing brain owner	"The brain decides when you will experience pain."	"The brain gives rise to the experience of pain."
Ornstein, 1992	Popular science book	Consciousness	Deciding brain versus a later experiencing brain owner	"It is as if the brain, below our awareness, spends half a second deciding whether we should be allowed to know what just happened. If it decides that it is best that we know, then it also informs us." (p. 147)	"It is as if attentional mechanisms, below our awareness, spend half a second processing what just happened in order to select on what to focus. The information that was selected then becomes conscious." Alternative interpretation: "It is as if unconscious processes, below our awareness, spend half a second filtering what just happened. Whatever survives this filtering (i.e., corresponds to our unconscious defense mechanisms), becomes conscious."
Pearson & Clifford, 2005	Research article, *Psychological Science*	Consciousness	Deciding brain versus an experiencing brain owner	"When your brain decides what you see: Grouping across monocular, binocular, and stimulus rivalry" (article title)	"When neural processes determine the contents of your perception: Grouping across monocular, binocular, and stimulus rivalry"

Table 1. (*continued*)

Publication	*Publication Type*	*Field*	*Interaction Type*	*Quote (Representative Example)*	*Rephrasing to Remove the DSF*
Rizzolatti & Sinigaglia, 2008	Popular science book	Mirror neurons	Understanding brain that interprets motor competencies versus brain owner who uses high cognitive faculties	"…we could use our higher cognitive faculties to reflect on what we have perceived and infer the intentions, expectations or motivations of others that would provide us with a reason for their acts, but our brain is able to understand these latter immediately on the basis of motor competencies alone, without the need of any kind of reasoning." (p. xii)	"…we could use our higher cognitive faculties to reflect on what we have perceived and infer the intentions, expectations or motivations of others that would provide us with a reason for their acts, but we are unconsciously able to understand these latter immediately on the basis of motor competencies alone, without the need of any kind of reasoning."
Simon et al., 2010	Research article, *Cortex*	Memory disorders	Remembering brain versus forgetting brain owner	"When the brain remembers, but the patient doesn't: Converging fMRI and EEG evidence for covert recognition in a case of prosopagnosia" (article title)	"When there are neural memory traces but the patient doesn't remember: Converging fMRI and EEG evidence for covert recognition in a case of prosopagnosia"
Smythies, 2005	Review article, *Journal of the Royal Society of Medicine*	Consciousness	Deciding brain versus an experiencing brain owner	"How the brain decides what we see" (article title)	"How neural processes determine the contents of your perception"
Soon et al., 2008	Research article	Free will	Deciding brain versus a later informed brain owner	"…the brain had already unconsciously made a decision to move even before the subject became aware of it" (p. 543)	"…unconscious motor-preparatory neural activity began even before the subject became aware of it."
Sternberg, 2010	Popular science book	Free will and moral responsibility	Brain in charge versus owner held responsible	*My brain made me do it: The rise of neuroscience and the threat to moral responsibility* (book title)	*The rise of neuroscience and the threat to moral responsibility* (book title)
Wehrenberg, 2011	Popular science book	Depression	A brain that makes its owner depressed versus a brain owner who tries to change his or her brain	"…you can use your brain to change your brain." (p. 11). Book title: *The 10 best-ever depression management techniques: Understanding how your brain makes you depressed and what you can do to change it*	"…your behavior can change your brain." Book title: *The best-ever depression management techniques: Understanding the neural mechanisms that cause your depression and how to change them*

Seymour, & Dolan, 2006), morality (Parkinson et al., 2011; Borg, Lieberman, & Kiehl, 2008; Moll, Zahn, de Oliveira-Souza, Krueger, & Grafman, 2005; Greene, Nystrom, Engell, Darley, & Cohen, 2004), the self (Gillihan & Farah, 2005; Decety & Sommerville, 2003; Kircher & David, 2003), consciousness (Tononi, 2013; Dehaene & Changeux, 2011; Crick & Koch, 2003), or free will (Maoz et al., 2015; Haggard, 2005, 2008; Soon et al., 2008; Libet, Gleason, Wright, & Pearl, 1983). Tectonic conceptual motion of this sort is seldom smooth, as the DSF exemplifies.[2]

Possibly, as part of its growing prominence and cultural importance, there is a recent strive in the cognitive sciences to improve working practices and arrive at more standardized and reproducible methods of gathering, analyzing, and reporting data (e.g., Cumming, 2014; Ioannidis et al., 2014; Simmons et al., 2011). This would be considerably reinforced by an accompanying strive for awareness of the underlying assumptions in the field and when they are violated. DSF writing is an important example of such a violation.

Scientists and philosophers warn that dualistic thinking, prevailing among lay people (Bloom, 2004, 2005; Damasio, 1994), is both wrong and socially dangerous (Dawkins, 2006; Greene, 2006). This is doubly true for the writings of neuroscientists, who the public perceives as authorities on the brain and the mind and possibly as role models for careful and rigorous thinking. When dualistic notions among neuroscientists and the general public weaken enough for humans to intuitively interpret DSF writing in nondualistic terms, committing the DSF would be merely sloppy. Until then, if cognitive neuroscience is to advance toward its goal of providing a clear and coherent account of the brain as the foundation for the mind, neuroscientists should pay more attention to lurking closet dualism and would do well to steer clear of the DSF.

Acknowledgments

L. M. was supported by the Human Frontier Science Program, the Weizmann Institute of Science's National Postdoctoral Award Program for Advancing Women in Science. U. M. was supported by Florida State University's "Big Questions in Free Will" initiative, funded by the Templeton Foundation; by the Ralph Schlaeger Charitable Foundation; by the Bial Foundation; and by the Van Leer Jerusalem Institute. Versions of this article were presented and discussed at the Towards a Science of Consciousness Conference, 2012; at the Society for Philosophy and Psychology Annual Meeting, 2012; at the Advanced philosophy students conference, Tel Aviv University, 2009; and the Neuroscience and Society conference, Van Leer institute, Jerusalem, 2009. We thank the participants of those conferences for their insightful comments. We are especially indebted to Ralph Adolphs, Marcelo Dascal, Nathan Faivre, Alfred Mele, Adina Roskies, Max Velmans, and Gideon Yaffe for thoughtful and highly constructive comments on this manuscript. We further acknowledge our debt to Bennett and Hacker (2003), who featured more prominently in some earlier drafts of this paper.

Reprint requests should be sent to Liad Mudrik, California Institute of Technology, 1200 E California Blvd, Pasadena, CA 91125, or via e-mail: liadm@caltech.edu, liadmu@gmail.com.

Notes

1. Importantly, this fallacy does not depend on rejecting the personification of the brain (termed by Bennett and Hacker [2003] as "the mereological fallacy"—the ascription of psychological predicates to the brain or its parts). Hence, even if one accepts the ascription of psychological predicates to the brain (e.g., if one allows sentences like "the brain decides" or "the brain wants"; see Bennett & Hacker, 2003; Chomsky, 1995, for criticism), one should reject the ascription of opposing psychological predicates to the brain and its owner (e.g., "the brain decides before you do" or "the brain wants but I don't"). Below, we explain why this opposition cannot be accommodated within a materialistic point of view and why it confuses neuroscientific writing.
2. In that respect, there are ongoing debates about other potential fallacies in neuroscience, such as whether consciousness holds any special function (e.g., Mudrik, Faivre, & Koch, 2014; Baars, 2005; Block, 1995), the role of causality in neuroscience (e.g., Campbell, O'Rourke, & Silverstein, 2007), the scope and explanatory power of reductionism in neuroscience (e.g., Bickle, 1998, 2003), and the role of the brain in the free-will and moral-responsibility debates (e.g., Maoz & Yaffe, forthcoming; Maoz et al., 2015; Haggard, 2008). The DSF and its origin may be related to these debates.

REFERENCES

Aamodt, S., & Wang, S. (2008). *Welcome to your brain: Why you lose your car keys but never forget how to drive and other puzzles of everyday life*. New York: Bloomsbury.

Avise, J. C. (2001). Evolving genomic metaphors: A new look at the language of DNA. *Science, 294,* 86–87.

Baars, B. J. (1997). Some essential differences between consciousness and attention, perception, and working memory. *Consciousness and Cognition, 6,* 363–371.

Baars, B. J. (2005). Global workspace theory of consciousness: Toward a cognitive neuroscience of human experience. *Progress in Brain Research, 150,* 45–53.

Bechtel, W. (2009). Molecules, systems, and behavior: Another view of memory consolidation. In J. Bickle (Ed.), *The Oxford handbook of philosophy and neuroscience* (pp. 13–40). Oxford: Oxford University Press.

Bennett, M. R., & Hacker, P. M. S. (2003). *Philosophical foundations of neuroscience*. Malden, MA: Blackwell.

Bering, J. M., & Bjorklund, D. F. (2004). The natural emergence of reasoning about the afterlife as a developmental regularity. *Developmental Psychology, 40,* 217–233.

Bickle, J. (1998). *Psychoneural reduction: The new wave*. Cambridge, MA: MIT Press.

Bickle, J. (2003). *Philosophy and neuroscience: A ruthlessly reductive account*. Dordrecht, Netherlands: Kluwer Academic Publisher.

Block, N. (1995). On a confusion about a function of consciousness. *Behavioral and Brain Sciences, 18,* 227–287.

Bloom, P. (2004). *Descartes' baby: How the science of child development explains what makes us human*. New York: Basic Books.

Bloom, P. (2005). Worse than creationism. *American Psychological Society Observer, 18,* 10.

Bloom, P. (2007). Religion is natural. *Developmental Science, 10,* 147–151.

Borg, J. S., Lieberman, D., & Kiehl, K. A. (2008). Infection, incest, and iniquity: Investigating the neural correlates of disgust and morality. *Journal of Cognitive Neuroscience, 20,* 1529–1546.

Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York: Basic Books.

Brown, T. L. (2003). *Making truth: Metaphor in science*. Urbana: University of Illinois Press.
Cacioppo, J. T., & Decety, J. (2009). What are the brain mechanisms on which psychological processes are based? *Perspectives on Psychological Science, 4,* 10–18.
Campbell, J. K., O'Rourke, M., & Silverstein, H. (2007). *Causation and explanation*. Cambridge, MA: MIT Press.
Cerf, M., Thiruvengadam, N., Mormann, F., Kraskov, A., Quiroga, R. Q., Koch, C., et al. (2010). On-line, voluntary control of human temporal lobe neurons. *Nature, 467,* 1104–1108.
Chew, M. K., & Laubichler, M. D. (2003). Natural enemies—Metaphor or misconception? *Science, 301,* 52–53.
Chomsky, N. (1995). Language and nature. *Mind, 104,* 1–61.
Crick, F. (1994). *The astonishing hypothesis: The scientific search for the soul*. New York: C. Scribner.
Crick, F., & Koch, C. (2003). A framework for consciousness. *Nature Neuroscience, 6,* 119–126.
Cumming, G. (2014). The new statistics: Why and how. *Psychological Science, 25,* 7–29.
Damasio, A. R. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: G. P. Putnam's Sons.
Damasio, A. R., Everitt, B., & Bishop, D. (1996). The somatic marker hypothesis and the possible functions of the prefrontal cortex [and discussion]. *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences, 351,* 1413–1420.
Dawkins, R. (2006). *The God delusion*. Boston, MA: Houghton Mifflin.
De Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. *Science, 313,* 684–687.
Decety, J., & Sommerville, J. A. (2003). Shared representations between self and other: A social cognitive neuroscience view. *Trends in Cognitive Sciences, 7,* 527–533.
Dehaene, S., & Changeux, J. P. (2011). Experimental and theoretical approaches to conscious processing. *Neuron, 70,* 200–227.
Dennett, D. C. (1984). *Elbow room: The varieties of free will worth wanting*. Cambridge, MA: MIT Press.
Descartes, R. (1985). *The philosophical writings of Descartes (CSM)* (J. Cottingham, R. Stoothoof, & D. Murdoch, Trans.). Cambridge: Cambridge University Press.
Edelman, G. M. (1989). *The remembered present: A biological theory of consciousness*. New York: Basic Books.
Farah, M. J. (1994). Perception and awareness after brain damage. *Current Opinion in Neurobiology, 4,* 252–255.
Fine, C. (2006). *A mind of its own: How your brain distorts and deceives*. New York: W.W. Norton & Company.
Fischer, J. M., & Ravizza, M. (Eds.) (1984). *Perspectives on moral responsibility*. Ithaca, NY: Cornell University Press.
Frankfurt, H. G. (1969). Alternate possibilities and moral responsibility. *The Journal of Philosophy, 66,* 829–839.
Frith, C. (2007). *Making up the mind: How the brain creates our mental world*. Malden, MA: Blackwell Publication.
Gazzaniga, M. S. (2000). *The mind's past*. Berkeley: University of California Press.
Gazzaniga, M. S. (2006). Facts, fictions and the future of neuroethics. In J. Illes (Ed.), *Neuroethics: Defining the issues in theory, practice, and policy* (pp. 141–148). Oxford: Oxford University Press.
Gazzaniga, M. S. (2010). Neuroscience and the correct level of explanation for understanding mind. *Trends in Cognitive Sciences, 14,* 291–292.
Gillihan, S. J., & Farah, M. J. (2005). Is self special? A critical review of evidence from experimental psychology and cognitive neuroscience. *Psychological Bulletin, 131,* 76–97.
Gold, I., & Stoljar, D. (1999). A neuron doctrine in the philosophy of neuroscience. *Behavioral and Brain Sciences, 22,* 809–830.
Greene, J. D. (2006). Social neuroscience and the soul's last stand. In A. Todorov, S. Fiske, & D. Prentice (Eds.), *Social neuroscience: Toward understanding the underpinnings of the social mind* (pp. 263–273). Oxford: Oxford University Press.
Greene, J. D., & Cohen, J. (2004). For the law, neuroscience changes nothing and everything. *Philosophical Transactions of the Royal Society, Series B, Biological Sciences, 359,* 1775–1785.
Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., & Cohen, J. D. (2004). The neural bases of cognitive conflict and control in moral judgment. *Neuron, 44,* 389–400.
Grinde, B. (1996). The biology of visual aesthetics. *Journal of social and evolutionary systems, 19,* 31–40.
Haggard, P. (2005). Conscious intention and motor cognition. *Trends in Cognitive Sciences, 9,* 290–295.
Haggard, P. (2008). Human volition: Towards a neuroscience of will. *Nature Reviews Neuroscience, 9,* 934–946.
Hart, H. L. A. (1968). *Punishment and responsibility*. Oxford: Oxford University Press.
Honderich, T. (1988). *A theory of determinism: The mind, neuroscience, and life hopes*. Oxford: Clarendon Press.
Ioannidis, J., Munafò, M. R., Fusar-Poli, P., Nosek, B. A., & David, S. P. (2014). Publication and other reporting biases in cognitive sciences: Detection, prevalence, and prevention. *Trends in Cognitive Sciences, 18,* 235–241.
Isnard, J., Magnin, M., Jung, J., Mauguière, F., & Garcia-Larrea, L. (2011). Does the insula tell our brain that we are in pain? *Pain, 152,* 946–951.
Jastorff, J., Clavagnier, S., Gergely, G., & Orban, G. A. (2011). Neural mechanisms of understanding rational actions: Middle temporal gyrus activation by contextual violation. *Cerebral Cortex, 21,* 318–329.
Kane, R. (Ed.) (2002). *The Oxford handbook of free will*. New York: Oxford University Press.
Keysers, C., & Perrett, D. I. (2002). Visual masking and RSVP reveal neural competition. *Trends in Cognitive Sciences, 6,* 120–125.
Kim, J. (1998). *Mind in a physical world: An essay on the mind–body problem and mental causation*. Cambridge, MA: MIT Press.
Kircher, T., & David, A. (2003). *The self in neuroscience and psychiatry*. Cambridge, MA: Cambridge University Press.
Knobe, J. (2014). Free will and the scientific vision. In E. Machery & E. O'Neil (Eds.), *Current controversies in experimental philosophy* (pp. 69–85). London: Routledge.
Koch, C. (2009). Free will,physics, biology, and the brain. In N. Murphy, G. F. R. Ellis, & T. O'Connor (Eds.), *Downward causation and the neurobiology of free will* (pp. 31–52). Springer-Verlag.
Koch, C. (2012). *Consciousness: Confessions of a romantic reductionist*. The MIT Press.
Kornmeier, J., & Bach, M. (2009). Object perception: When our brain is impressed but we do not notice it. *Journal of Vision, 9,* 1–10.
LaBerge, D. (1995). *Attentional processing: The brain's art of mindfulness*. Cambridge, MA: Harvard University Press.
Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: Chicago University Press.
Lau, H., & Passingham, R. E. (2007). Unconscious activation of the cognitive control system in the human prefrontal cortex. *Journal of Neuroscience, 27,* 5805–5811.
LeDoux, J. E. (2002). *Synaptic self: How our brains become who we are*. Penguin Books.
Leyden, J. & Kleinig, T. (2008). The role of the basal ganglia in data processing. *Medical hypotheses, 71,* 61–64.
Libet, B. (2003). Can conscious experience affect brain activity? *Journal of Consciousness Studies, 10,* 24–28.
Libet, B., Gleason, C. A., Wright, E. W., & Pearl, D. K. (1983). Time of conscious intention to act in relation to onset of

cerebral activity (readiness-potential). The unconscious initiation of a freely voluntary act. *Brain, 106,* 623–642.
Maoz, U., Mudrik, L., Rivlin, R., Ross, I., Mamelak, A., & Yaffe, G. (2015). On reporting the onset of the conscious intention to move. In A. Mele (Ed.), *Surrounding free will: Philosophy, psychology, neuroscience* (pp. 184–202). Oxford: Oxford University Press.
Maoz, U., & Yaffe, G. (2013). Neuroscience and the law. In M. Gazzaniga, R. B. Ivry, and G. R. Mangun (Eds.), *Cognitive neuroscience, the biology of mind* (4th ed., pp. 1025–1033). New York: Norton & Company.
Mele, A. R. (2007). *Decisions, intentions, urges, and free will: Why Libet has not shown what he says he has causation and explanation*. Cambridge, MA: MIT Press.
Moll, J., Zahn, R., de Oliveira-Souza, R., Krueger, F., & Grafman, J. (2005). The neural basis of human moral cognition. *Nature Reviews Neuroscience, 6,* 799–809.
Monroe, A. E., Dillon, K. D., & Malle, B. F. (2014). Bringing free will down to earth: People's psychological concept of free will and its role in moral judgment. *Consciousness and Cognition, 27,* 100–108.
Montague, P. R. (2008). Free will. *Current Biology, 18,* R584–R585.
Morse, S. J. (2004). New neuroscience, old problems. In B. Garland (Ed.), *Neuroscience and the law: Brain, mind, and the scales of justice* (pp. 157–198). New York: Dana Press.
Moseley, L. (2003). Unraveling the barriers to reconceptualization of the problem in chronic pain: The actual and perceived ability of patients and health professionals to understand the neurophysiology. *The Journal of Pain, 4,* 184–189.
Mudrik, L., Breska, A., Lamy, D., & Deouell, L. Y. (2011). Integration without awareness: Expanding the limits of unconscious processing. *Psychological Science, 22,* 764–770.
Mudrik, L., Faivre, N., & Koch, C. (2014). Information integration without awareness. *Trends in Cognitive Sciences, 18,* 488–496.
Nagel, T. (1976). Moral luck. *Proceedings of the Aristotelian Society, Supp, 50,* 137–151.
Nahmias, E., & Thompson, M. (2014). A naturalistic vision of free will. In E. Machery & E. O'Neil (Eds.), *Current controversies in experimental philosophy* (pp. 86–103). London: Routledge.
Nichols, S. (2004). The folk psychology of free will: Fits and starts. *Mind & Language, 19,* 473–502.
Ornstein, R. (1992). *The evolution of consciousness: The origins of the way we think*. Simon & Schuster.
Parkinson, C., Sinnott-Armstrong, W., Koralus, P. E., Mendelovici, A., McGeer, V., & Wheatley, T. (2011). Is morality unified? Evidence that distinct neural systems underlie moral judgments of harm, dishonesty, and disgust. *Journal of Cognitive Neuroscience, 23,* 3162–3180.
Pearson, J., & Clifford, C. W. G. (2005). When your brain decides what you see grouping across monocular. *Binocular, and Stimulus Rivalry, Psychological Science, 16,* 516–519.
Petrement, S. (1973). Dualism in philosophy and religion. In P. P. Wiener (Ed.), *Dictionary of the history of ideas: Studies of selected pivotal ideas, II* (pp. 38–44). New York: Scribner.
Pincus, J. H. (2001). *Base instincts: What makes killers kill?* New York: Norton.
Poldrack, R. A. (2011). Inferring mental states from neuroimaging data: From reverse inference to large-scale decoding. *Neuron, 72,* 692–697.
Putnam, H. (1967). Psychological predicates. In W. H. Capitan & D. D. Merrill (Eds.), *Art, mind, and religion* (pp. 158–167). Pittsburgh, PA: University of Pittsburgh Press.
Raffone, A., Srinivasan, N., & van Leeuwen, C. (2014). Introduction: Perceptual awareness and its neural basis: Bridging experimental and theoretical paradigms. *Philosophical Transactions of the Royal Society, Series B, Biological Sciences, 369,* 20130203.
Reber, T. P., Luechinger, R., Boesiger, P., & Henke, K. (2014). Detecting analogies unconsciously. *Frontiers in Behavioral Neuroscience, 8,* 9.
Rey, G. (1997). *Contemporary philosophy of mind*. Cambridge, MA: Blackwell.
Rizzolatti, G., & Sinigaglia, C. (2008). *Mirrors in the brain: How our minds share actions, emotions, and experience*. Oxford University Press.
Roskies, A. (2006). Neuroscientific challenges to free will and responsibility. *Trends in Cognitive Sciences, 10,* 419–423.
Schlick, M. (1939). When is a man responsible? In *Problems of ethics* (pp. 143–156). New York: Prentice-Hall.
Shoemaker, S. (1981). Some varieties of functionalism. *Philosophical Topics, 12,* 83–118.
Simon, S. R., Khateb, A., Darque, A., Lazeyras, F., Mayer, E., & Pegna, A. J. (2010). When the brain remembers, but the patient doesn't: Converging fMRI and EEG evidence for covert recognition in a case of prosopagnosia. *Cortex, 47,* 825–838.
Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science, 22,* 1359–1366.
Sklar, A. Y., Levy, N., Goldstein, A., Mandel, R., Maril, A., & Hassin, R. R. (2012). Reading and doing arithmetic nonconsciously. *Proceedings of the National Academy of Sciences, U.S.A., 109,* 19614–19619.
Smart, J. (1959). Sensations and brain processes. *Philosophical Review, 68,* 141–156.
Smilansky, S. (2000). *Free will and illusion*. Oxford: Oxford University Press.
Smythies, J. (2005). How the brain decides what we see. *JRSM, 98,* 18–20.
Soon, C. S., Brass, M., Heinze, H. J., & Haynes, J. D. (2008). Unconscious determinants of free decisions in the human brain. *Nature Neuroscience, 11,* 543–546.
Stephan, A. (2006). The dual role of "emergence" in the philosophy of mind and in cognitive science. *Synthese, 151,* 485–498.
Sternberg, E. J. (2010). *My brain made me do it: The rise of neuroscience and the threat to moral responsibility*. New York: Prometheus Books.
Strawson, P. F. (1962). Freedom and resentment. *Proceedings of the British Academy, 48,* 1–25.
Tononi, G. (2013). Integrated information theory of consciousness: An updated account. *Archives Italiennes de Biologie, 150,* 290–326.
Turner, M., & Fauconnier, G. (2002). Metaphor, metonymy, and binding. In R. Dirven & R. Pörings (Eds.), *Metaphor and metonymy in comparison and contrast* (pp. 469–488). Berlin, Germany: Mouton de Gruyter.
Van Gulick, R. (2001). Reduction, emergence and other recent options on the mind/body problem. A philosophic overview. *Journal of Consciousness Studies, 8,* 1–34.
Velmans, M. (2003). Preconscious free will. *Journal of Consciousness Studies, 10,* 42–61.
Vul, E., Harris, C. R., Winkielman, P., & Pashler, H. (2009). Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition. *Perspectives on Psychological Science, 4,* 274–290.
Wehrenberg, M. (2011). *The 10 best-ever depression management techniques: Understanding how your brain makes you depressed and what you can do to change it*. W. W. Norton.
Weiskrantz, L. (1996). Blindsight revisited. *Current Opinion in Neurobiology, 6,* 215–220.
Zimmerman, M. J. (1988). *An essay on moral responsibility*. Totowa, NJ: Rowman & Littlefield.